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Environmental law & the limits of markets

Jonathan Benson*

A number of writers have drawn on Hayek's epistemic defence of market institutions to argue that free-markets and tort law are best placed to overcome the knowledge problems associated with the environmental sphere. This paper argues to the contrary, that this Austrian School approach itself suffers from significant knowledge problems. The first of these relates to the ability of Austrian economics to assign victim compensation and the second to the difficulty of establishing causation in complex environmental problems. The paper will also show how alternative approaches may not suffer from these epistemic challenges and are better placed to overcome them.

Key words: Environment, Tort law, Austrian economics, Hayek, Knowledge, Causation, Compensation

JEL classifications: A12, B53, K13

1. Introduction

Central to the Austrian school of economics' advocacy of market institution is their ability to overcome the basic economic problem of society, that being the problem of knowledge. The market is said to be the best method for communicating and utilising the varied and dispersed knowledge in society. A number of Austrian and Hayekian writers, notably [Sagoff \(2008B\)](#), [Pennington \(2001, 2005\)](#) and [Cordato \(1995, 2004\)](#), have developed on this epistemic justification for market institutions to create a uniquely Austrian approach to environmental economics. Rejecting alternative approaches for suffering from substantial knowledge problems, these Austrians defend free-market environmentalism on the grounds that it can overcome the epistemic challenges of environmental problems.

This paper will argue to the contrary, that the Austrian school's approach to the environment, particularly its use of tort law, itself suffers from significant knowledge problems. It will be argued that markets, far from overcoming the epistemic challenges in the environmental sphere, suffer from significant knowledge problems which question their ability to deal with environmental problems. Important

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tensions will be shown to exist between the advocacy of tort law and the epistemological foundations of Austrian economics. The first of these problems relates to the ability to assign compensation given the epistemological assumptions of Austrian economics and will call into question the Austrian use of tort law generally. The second will challenge the possibility of determining causation between polluters' and plaintiffs' rights violations in complex environmental problems. The paper will also suggest how alternative approaches are better placed to overcome these epistemic challenges.

Section 2 will lay out the Austrian school's approach to the environment and its use of tort law. Section 3 will argue that, given the Austrian account of well-being and price formation, Austrian economics faces insurmountable epistemic barriers when it comes to calculating victims' compensation. This will show a foundational problem with assigning compensation which affects all Austrian uses of tort law, not only those in the environmental sphere. The section will also show how this is due to the framework of Austrian economics and that alternative approaches may not suffer from the same problems. Section 4 will argue that, given the complexity of ecological and biological systems, there are significant knowledge problems which prohibit the determination of causation as it is required in tort law. These knowledge problems not only hold back the possibility of courts ordering compensation but importantly also injunctive relief. Alternative approaches, however, which have different causation requirements, will face a lower epistemic burden. Finally, Section 5 will conclude by discussing the implications of these arguments for the market coordination and the ability of markets to solve environmental problems.

2. The Austrian approach to the environment

Environmental problems are problems of the damaging effects of human activities on the biophysical environment. This includes harmful effects on climate systems, ecosystems, biodiversity and natural resources, but also the detrimental effects on human health which result from the human impact on the environment.

A prominent approach for addressing such problems comes from neo-classical environmental economics (Pearce and Barbier, 2000; Pigou, 1946). For the neo-classical approach, environmental problems are an example of a market failure, resulting from preferences for environmental goods and harms not being represented in the market. The solution is to apply market and market-mimicking mechanisms, such as emissions taxes, cap and trade schemes and cost-benefit analysis, in order to bring environmental goods into the market sphere. These solutions attempt to determine optimal levels of pollution through calculations of social and private costs, and represent environmental values by calculating shadow prices for environmental goods. By placing prices on pollution and ecological goods, an efficient allocation of resources can be achieved to maximise welfare. From the Austrian perspective these neo-classical solutions involve forms of economic calculation which are not possible given our epistemic limitations (Cordato, 1992, 1995, 2004; Sagoff, 2008B; O'Driscoll and Rizzo, 1985). For example, calculations of social and private cost are not possible as the information required is dispersed throughout society, often tacit or subjective, and changes over time. Arriving at an optimal pollution tax would require information relating to all costs, all buyers' and sellers' preferences and the condition of efficiency in all the related markets. This information simply cannot be centralised to a team

of experts so they can calculate the efficient policy. The Austrian school, therefore, rejects the neo-classical approach for suffering from an unsurmountable epistemic burden.

This epistemic critique is combined with an epistemic defence of free-market institutions. Hayek (1948A, 1948B) argued that knowledge in society was dispersed among many different individuals and that the only way to overcome this ‘division of knowledge’ was to rely on the communicative ability of market prices to spread information about the relative scarcity of goods and to coordinate individuals in their actions. Individuals can act on their own local knowledge and through acts of buying and selling, influence price formation and spread their knowledge throughout the economy. On this framework the environment is best managed by establishing property right in environmental goods and allowing the market to spontaneously coordinate individuals in their use of them (Pennington, 2001, 2005).

Austrians reject the neo-classical view of efficiency where policy should aim to maximise aggregate welfare, instead favouring the concept of catallactic efficiency. Markets’ prices allow for the coordination of individuals in pursuit of their individual ends, and where these ends come into conflict it is the role of courts to intervene to promote plan coordination. On this approach, environmental problems are reduced to problems of human conflict (Cordato, 2004). If someone pollutes the environment then this would constitute a property right violation and the owner of the relevant goods would have a claim against the polluter. Like other property rights violations, environmental problems would then be resolved within a legal system of tort law (Cordato, 1992, 1995, 2004; Rothbard, 1982; McGee and Block, 2011). If someone’s actions have damaged you, or your property, then you can bring a claim against that individual in a tort case. The role of the court is to identify rights violations and establish whether the defendant is liable for them. If so, the judge can then order injunctive relief to stop the damaging activity, promoting plan coordination and catallactic efficiency. In addition to injunctive relief, Austrians also advocate the payment of compensation in order to ‘make the victim whole’ (Cordato, 2004; O’Driscoll and Rizzo, 1985). A judge cannot only order an end to harmful activity but also order the defendant to pay damages to those who are injured by their pollution.

In the Austrian approach economic calculations are replaced by a tort system which looks to identify rights violations and establish causation. Problems of pollution, biodiversity loss and the protection of natural resources are not issues for bureaucratic managers but for judges.¹ The rest of this paper will argue that this free-market tort law approach itself suffers from significant epistemic challenges.

3. Compensation

The first of these epistemic problems relates to the ability to assign victim compensation. This problem challenges the Austrian use of tort law generally, showing that compensation, a central element of all tort law, is not possible given the foundations of Austrian economics. The epistemic burden for compensation is lower in Austrian

¹ Some Austrians support a move away from a monopoly on the legal system towards a competitive system of private courts (Stringham, 2015). This approach is not advocated by most Austrian accounts of environmental economics and is beyond the scope of this paper.

than neo-classical economics. Unlike a neo-classical view of efficiency, catalytic efficiency does not require that the precise level of compensation be calculated in order to maximise net welfare. However, Austrians still advocate that compensation be paid and it will be argued that their epistemic burden is still too high. That although optimal compensation is not required, calculating compensation cannot get off the ground given the assumptions of Austrian theory. An example will also be given of how other approaches may not suffer the same epistemic challenges.

If a judge assigns liability, then it may be that the defendant and plaintiff can come to a mutual agreement, so that the defendant can either buy the relevant property right so as to wholly secure the right to pollute, or pay a fee to the plaintiff in exchange for permission to pollute on their property. In many cases, however, agreement won't be possible and it will be the role of a judge to order injunctive relief and make the defendant pay compensation in order 'to make the victim whole' (Cordato, 2004; O'Driscoll and Rizzo, 1985)². What is meant by the phrase 'making the victim whole' is not made explicitly clear. What is exactly being compensated for and to what criteria should the level of compensation be set? There are two possible ways in which the phrase could be meant:

- (1) The defendant must compensate for the loss in market price.
- (2) The defendant must compensate for the individual's loss of well-being.

In (1) compensation is set to compensate for the loss in market price of the goods damaged: either the decrease in its price due to damages or if it is completely destroyed the whole price of the good. Alternatively, in (2) compensation is to compensate for the loss in the victim's well-being. This not only includes economics costs but any psychological or emotional damage they experienced as result of the property right violation.

Before examining (1) and (2), the alternative of full restitution needs to be considered. Full restitution involves the restoration of the good which was damaged. The difficulty with full restitution is that in many, if not most, cases it will not be possible. Taking environmental goods as an example, these goods are often highly unique and can be damaged in such a way that they cannot be restored to their original condition. So most of the time full restitution will not be possible and compensation criteria will be required.

Even in those cases where full restitution may be possible, the Austrian framework presents an important challenge to the possibility of restitution which would need to be overcome. Restitution involves restoring the damaged property to its previous state. However, for the Austrian school, social objects cannot be defined or described in purely physical terms but only in terms of the beliefs people hold about those objects (Hayek, 1952). An item of private property, for example, cannot be defined separately from the views the property owner holds about it. Therefore, even if an object is perfectly restored physically, its meaning and significance to the owner may be altered as a result. If a family heirloom is damaged and then restored, the object may no longer embody the same history it did previously. It will no longer be the object used and owned by past relatives, and it will lose its particular meaning for the owner. It is then, for the Austrian school, in one important respect not restored to its original condition. It cannot be said to be the same because a key element that defines it has changed.

² Depending on the legal system, it may be a judge or a jury who assigns compensation. For simplicity and consistency this paper will refer to judges, but the argument would also apply to a jury.

This challenge to the possibility of restitution in an Austrian framework may be surmountable, but it would need to be addressed before restoration could be advocated. Supposing that it was overcome, full restoration would still only be possible in a small number of cases. Going forward, then, the focus will be on cases where compensation is required.

3.1 *Market price compensation*

Beginning with (1), compensation could be set with respect to the market price of damages. There is a complication when this form of compensation is applied to human health. Can we possibly say what the loss in price is when a tort causes a victim to lose a limb or develop a long-term illness? However, (1) can be taken to apply only to external goods and not health effects. This interpretation of (1) will be considered here and it will be shown that even the apparently simpler case of external property involves serious epistemic problems.

It is important to see that the goods which are damaged will not for the most part have already been assigned a market price. At the time the damages occurred, these goods will be in the process of being consumed or used by their owner and will therefore not be present in the market. They will not, at the time of damages, be within the process of market exchange. A judge will not then be able to simply set compensation at a given price, nor will they be able to compare a per-damage price to a post-damage price and set compensation equal to the difference. Instead, a judge would have to assess the damages and assign a market price of their own.

Assigning a market price to a good, however, is impossible in an Austrian framework. For Austrians, prices do not represent any objective form of economic value which can be measured by an observer (Sagoff, 2011). Objective theories of economic value were dismissed by Hayek in his critique of 'scientific objectivism' (Hayek, 1952; O'Neill, 2004). As discussed, social objects cannot be defined purely in physical terms but only in reference to the beliefs that people hold about them. Prices do not represent a given objective value but merely a good's exchange value, that is, what can be obtained for that good in the market. Within the market process, participants act on their own knowledge and preferences, demanding and purchasing certain goods, and producing market prices as a result. Those goods whose demand is high relative to supply will obtain higher prices, and those whose demand is low relative to supply will obtain lower prices. Goods are not defined in physical or objective terms but 'only in terms of the views people hold about' them (Hayek, 1952, p. 31).

Market prices of this sort cannot be calculated by a judge, as the information it would require is unobtainable by a single individual. Due to the 'division of knowledge' in society, information relating to people's tastes and preferences, and therefore demand, is dispersed throughout the economy and is only known to a small number of actors (Hayek, 1948A, 1948B). A judge would have to centralise all demand information relating to the damaged goods, and this is simply not possible, given the division of knowledge. Much of this knowledge will be subjective, such as individual preferences, so can only be known to market participants themselves. It will also include tacit knowledge which is embedded in practical skills and knowhow, and cannot be communicated in linguistic or statistical form. Rather such knowledge can only be expressed 'through social action, such as exchange or exercising a skill' (Horwitz, 1992, p. 198).

Tacit knowledge cannot be communicated to a courtroom, but can only be discovered within the market process.

For Austrians, then, without the spontaneous interaction of market participants within exchange, a price for a particular good cannot be known. As Cordato (1992, p. 213) argues, ‘the complexities of the knowledge problem prevent market observers from knowing what the price “should” be apart from what is generated in the market’. A judge has no way, given the epistemological foundation of the Austrian approach, to calculate such a price and then set compensation equal to it. The information which would be necessary to accomplish this cannot possibly be communicated to a judge in a courtroom.

It may be objected that a judge does not need to calculate the price of the particular good in question but could look at similar goods in the market and use their price to set compensation.

However, this does not take into account the local differences in goods which affect market prices. These differences can be physical differences or differences in the subjective views of the property holder. If the owner of a good believes there is some significant moral or aesthetic value in the good, then they are likely to sell only at a high price, if at all.³ Seemingly similar goods may then receive greatly different market prices. The market, by allowing people to act on local knowledge, is said to communicate these differences. Outside of exchange, however, the price of one good cannot be inferred from a similar good, as there are always unique differences. So, to set compensation in line with (1), it is necessary to calculate market prices, a requirement which is impossible in an Austrian framework. Therefore, even though Austrians do not require the calculation of optimal compensation, these epistemic assumptions rule out the possibility of market price compensation.

3.2 *Well-being compensation*

Turning to (2), compensation could be set to compensate for a victim’s loss in well-being. To understand what this involves, it is necessary to look at the account of well-being taken in Austrian economics. The account taken in the later Austrian school is based on preference satisfaction (Hayek, 2013; Mises 2003, 2012).⁴ What is good for people is the realisation or satisfaction of their wants and desires, whatever they may be. Austrians do not take a position on the content of these preferences, so all satisfaction of preferences is taken to be conducive to well-being. For instance, Bohm-Bawerk (quoted in Mises, 2003, p. 160) defines a person’s well-being as ‘everything that seems to him worth aiming at’, and in the same vein Mises (2012, p. 21) defines it as ‘that which acting men aims at because it is desirable in his eyes’. This is a subjective determination account of well-being (O’Neill, 1998). The object of well-being is not a particular brain state or the realisation of some objective good, but whatever is subjectively desired by the individual. The satisfaction of these subjective preferences is what defines well-being. Compensation should, therefore, be set in respect to the loss in a person’s preference satisfaction. It is not the purpose of this paper to take a position on

³ Austrians have argued similarly that property owners can act in relation to their property in accordance with individual moral values, and that this can affect market prices (Pennington, 2005).

⁴ Menger (1976), who is generally considered to be the father of Austrian economics, held a different more objective needs account of well-being. This view, however, was wholly rejected by later Austrians.

this account of well-being. Rather, it will argue that given this account and the assumption of Austrian economics, a judge will not be able to assign compensation.

The difficulty for the Austrian school is that it is impossible for a judge to determine what preferences have been denied by a property rights violation or the strength of those preferences. It is often thought that knowledge of someone's preferences can be derived from the observation of their behaviour. If someone chooses a pear and not an apple, then it can be inferred from observation that the person has a preference for pears over apples. However, Sagoff (2004, 2008A) rejects this, arguing that such examples overly simplify reality.

According to Sagoff, any one choice or action a person makes may be the result of any number of preferences, and it cannot be known which preference was acted upon. He gives an example of him buying cookies from a Girl Scout. An observer of this action would not be able to deduce what preference motivated Sagoff to purchase the cookies. It could be that he supported the Girl Scouts and wanted to help the organisation, or maybe that he wanted to appear generous. Alternatively, knowing that the Girl Scout was the daughter of his neighbour and a friend of his daughter, it may have been that he wanted to avoid friction with them. Or perhaps he just could not turn the young child away without buying something. In the real world there are hundreds of possible preferences which could motivate a particular action, and it is not possible to see which preference was actually acted upon. In the apple and pear example, there is a small and known opportunity set, either the person chooses the apple or the pear. However, in the real world the opportunity set is much larger and cannot be completely known. We cannot know all the possible preferences relating to Sagoff when he chooses to buy the cookies.

On Sagoff's own account, a judge will be unable to tell what preference has been violated due to a rights violation. If a farmer's land is polluted and becomes unworkable, what preference is now left unsatisfied? The preference to carry on a family tradition of farming, to work outside and with nature, to help provide needed goods for a community, for the monetary profits of farming, or for any of the goods these profits could buy. A judge cannot have perfect information about the opportunity set of the farmer or any plaintiff. A judge will then not be able to select which preference from this unknown opportunity set actually motivated the action. There is also an accompanying problem of multiple determinacies. It may be that not just one but a number of these preferences are motivating the farmer, and there may be no single determinant preference. A judge would then not only be in the position of having to locate all the preferences being acted on, but also how to compensate for all of these varied desires.

In addition to the problem of determining preferences, it is also not possible for a judge, in an Austrian framework, to know the strength of these preferences. For Austrians, what importance or value a person assigns to their preferences is neither observable nor measurable. As Mises (2012, p. 14) writes, 'There is no standard of greater or lesser satisfaction other than individual judgments of value, different for various people and for the same people at various times.' The importance of a preference is a subjective valuation which will differ from person to person. There is no scale to which preference satisfaction can be measured except that which is internal to the individual preference holder. The strength of a preference is therefore only known to that individual and cannot be known to a third party, including an observing judge.

A judge will not be able to set compensation in relation to losses in well-being, as in the Austrian approach, well-being is highly subjective and cannot be known to anyone except individuals themselves. Even though Austrians do not require the exact optimal-level of compensation, calculating compensation based on well-being is essentially ruled out in an Austrian epistemic framework and account of well-being. A judge will be unable to know what preferences have been violated or the strength of those preferences.

Therefore, whether or not compensation is set in accordance with (1) or (2), Austrians will experience significant epistemic problems which seriously limit a judge's ability to assign compensation. It is important to see that the reason for this is the particular assumptions taken in Austrian economics. These problems occur within a framework of Austrian epistemic and well-being assumptions and may, therefore, be less problematic for alternative approaches.

As an example, consider an objective list account of well-being which has gathered significant support in the fields of economics, political theory and environmental policy (Nussbaum, 2006; O'Neill, 1993; Sen, 1999). Now, it is beyond the scope of this paper to defend such an account; however, it can be shown that it has a lower epistemic burden when it comes to assigning compensation. On this account, well-being consists of the achievement or realisation of particular objective states, such as physical health or social relationships. Well-being is not determined by subjective desires but is objective. Things are, therefore, not good because we desire them, but rather we desire them because they are good. A list can then be produced of these objective goods, for example that given by Nussbaum (2006).

For this account, setting compensation in respect to well-being has a lower epistemic burden than the Austrian approach. On a preference satisfaction account a judge needs to locate a subjective preference which is violated when a good is damaged and determine its strength. However, on an objective list account, this is not required, as the ends for which a good can be used to promote well-being are already defined objectively and do not have to be located. It is then possible for a judge to conduct what Goodin (1989) calls 'means replacing' compensation. That is, a judge can compensate by providing a victim with equivalent, or somewhat equivalent, means for achieving a given end. For example, if someone loses a leg, a judge can determine which objective state is relevant, say mobility, and then compensate by providing an alternative means for achieving it, say a prosthetic leg or wheelchair. The judge can compensate by providing new means to achieve the relevant given objective states.

The epistemic burden is higher for a preference satisfaction accounts, as there is a need to locate a highly subjective and internal preference which has been unsatisfied and then also determine its strength. Alternatively, for an objective list account the ends are already given. This is not to say that objective list account does not confront epistemic difficulties of its own; for instance, determining the relevant objective ends can be problematic. However, it does show that its epistemic burden is lower than in an Austrian approach, where well-being is highly subjective and internal to the individual. Whether this alternative is acceptable will, of course, depend on how satisfying someone finds an objective list account of well-being. However, what this example aims to show is that the epistemic problems facing compensation in an Austrian approach are due to the assumptions of their framework. Alternative approaches may not, therefore, suffer from the same problem and may face a lower epistemic burden in relation to compensation.

4. Causation and complex environmental problems

The second epistemic problem in the tort law approach to the environment relates to the ability of judges to establish rights violations and causation. The complexity of biological and ecological systems often creates unsurmountable epistemic challenges to establishing causation for property rights violation. This is not to argue that there are no cases where causation can be established, but rather that in certain large and complex environmental problems the ability to do this is highly limited. It will also be suggested that more collective solutions are better placed to overcome these epistemic challenges.

The tort approach is based on a stringent principle of causation. It requires that the injury of which the plaintiff complains can be proved to be caused by the defendant. Austrians favour a principle of strict liability where, as Epstein (1973, p. 169) states, 'the analysis of causation is the tool which, *prima facie*, fastens responsibility upon the defendant'. Action, such as injunctive relief, cannot be taken unless there is proof of causation-in-fact: that a defendant or group of defendants can be shown to be causally responsible for rights violations of which the plaintiff complains.

Some Austrians, such as Rothbard (1982), have argued that the standard of proof relating to causation should be 'beyond a reasonable doubt'. That a judge or jury must be convinced 'beyond a reasonable doubt' of a causal link between the defendant and an injury is a very high standard of proof normally reserved for criminal prosecutions. A less stringent standard of 'more likely than not' is traditionally used in tort law. On this standard it must be shown that there is a greater than 50% chance that the plaintiff's injury was caused by the defendant rather than any other possible cause (Rosenberg, 1984).

However, even on the weaker 'more likely than not' standard of proof there can be significant epistemic problems when it comes to establishing causation-in-fact between a defendant and the injury of which the plaintiff complains. This is due to our limited knowledge of the ecological and biological systems within which environmental problems are embedded.

4.1 Pollutants and injuries

First, there are important epistemic challenges in establishing any link between an environmental pollutant and a plaintiff's rights violation. That is, determining whether the particular pollutant caused the particular injury which the plaintiff accuses.

Any event within an ecological or biological system can have any number of possible causes, some of which may be unknown. Unlike traditional tort cases, such as traffic accidents, where causation is often simple to establish, the complexity of environmental problems means that causation is often highly uncertain. It has been shown, for instance, that in laboratory conditions acid rain causes tree damage. However, it has also been shown that tree damage can be caused by high levels of ozone (Park, 2013). When both are present in the real world, this creates a level of uncertainty in the determination of causation.⁵ This same issue can also affect problems of human health. Illness and disease can be caused by pollutants but also by many alternative factors present in the background environment. Cancer, for instance, can be caused

⁵ Dolan (1990) also points to acid rain as an example where causation may be problematic.

by a number of toxins but also a wide range of lifestyle factors. Medical science cannot determine with certainty the direct cause of an illness or disease. The nature of the ecological and biological systems means establishing causation is often highly problematic and uncertain.

Courts must, therefore, rely on probabilistic scientific studies when dealing with such uncertainty. Taking human health as an example, courts have employed epidemiological studies to produce probabilities evidence of causation (Bernstein, 2008; Rosenthal, 2011). The subjects of these studies are populations rather than individuals, and they look to find the differences between the numbers of disease cases in different populations. The best that can be inferred about individual causation is a probability that any one case of a disease was due to a pollutant. Such probabilistic evidence may be ruled out completely by a 'beyond reasonable doubt' standard. Rothbard (1982), for instance, rejects statistical evidence on the ground that correlation is no proof of causation. However, these studies could be used as evidence on a 'more likely than not' standard as long as the percentage is greater than 50%.⁶ That is, to determine causation between a pollutant and an injury to an individual or group, studies must establish a greater than 50% probability.

Meeting this requirement is, however, highly problematic. Studies would have to show that an exposed population suffers from twice the number of disease cases as an unexposed population to establish that any one case or group of cases was the result of a pollutant. There must, therefore, be a very large increase in disease cases to show that any one individual or group within that population was 'more likely than not' injured by the pollutant. Most environmental pollutants will not, however, meet this requirement, and their likelihood of being the cause of any one case will be much below 50%. For example, less than 5% of pneumonia cases can be attributed to sulphur dioxide pollution (Brennan, 1993).

In cases where a greater than 50% probability can be established, other evidence may still be needed before causation can be proven. Even on a 'more likely than not' standard, some particularistic evidence may be required (Rosenberg, 1984). Such studies establish correlation and aggregate away differences between individuals, such as different lifestyle factors, so more evidence may be needed to show there is a link in a particular case. A plaintiff may also need to produce evidence of factors, such as their exposure levels as harm from pollutants may only develop at some threshold dose (Ceder, 2014). However, people are mostly unaware of the exact level they were exposed to a toxin, often because there can be long time lags between their exposure and their injury. Sufferers of mesothelioma, for example, have failed to prove causation between their condition and asbestos, despite the very strong link between the two.⁷ The complexity of environmental problems therefore produces significant epistemic challenges to determining causation between a pollutant and the injury of which a plaintiff complains.

4.2 Pollutants and sources

Proving that a pollutant was the cause of any particular injury faces significant epistemic challenges. Establishing causation-in-fact, however, also requires establishing a

⁶ This percentage is known as the 'attributable fraction'; that is, the fraction of disease cases which can be said to be caused by a toxin (Green *et al.*, 2011).

⁷ Cases where there is a very high attributable fraction are known as 'signature diseases' (Green *et al.*, 2011).

link between that injury-causing pollutant and the defendant. That is, establishing that a particular defendant was the source of the rights-violating pollutant.

This again faces significant knowledge problems. Ecosystems have no defined boundaries exhibiting levels of interconnectedness and interpenetration. Materials and pollutants can flow freely between different ecosystems and often over large distances. As a result environmental problems themselves have no clear boundaries and are not isolated to particular ecosystems or geographical areas. Land pollution, for instance, can spread to pollute water systems which then spread pollution even further afield. A particularly problematic example of this is airborne pollutants. Emissions are released by individuals into the air, where their travel path is then determined by the prevailing weather conditions at that time and emissions can be spread over vast distances and in multiple directions. They are dynamic and open to change, so the direction of travel may differ day to day. This means establishing the source of injury-causing pollutant faces many difficulties.

This problem is exacerbated by the fact that there may be thousands if not millions of possible polluters. Harms resulting from vehicle exhaust emissions, for example, will have very large number of polluters and victims. One way tort law advocates have tried to address this problem is by changing the subject of the tort. For example, if highways and roads are privatised, then their owners could be taken to court for vehicle emission pollution instead of attempting litigation against large numbers of vehicle owners (Anderson and Leal, 2001). However, this does not reduce the fact that there are still thousands or possibly millions of victims or that there are still possible thousands of road owners. Nor does this seem to be an option when it comes to household or industrial emissions, which can also involve large numbers.

An alternative strategy for dealing with the problem of linking pollutants to sources would be to join defendants and plaintiffs. In cases where there are many individual sources of a pollutant and many possible victims, it is possible to join groups of defendants and plaintiffs together for litigation. This strategy would certainly help reduce the epistemic burden of large-scale environmental problems. However, it does not eradicate these knowledge problems. Polluters and plaintiff can only be joined if they have similar cases. Knowledge of their individual circumstances may then still be required to show they possess such similarities. For instance, the dose of a pollutant a plaintiff received or whether particular polluter's emissions could come into contact with the plaintiff.

There is also still the additional problem of assigning liability. Although a group of emitters may injure a defendant, they may not have contributed equally and are not therefore equally liable. In response to this problem, it has been suggested that a market share liability approach could be used (Robinson, 1982). In the context of environmental problems, this principle would determine an individual's liability in relation to the proportion of emissions they produce. For complex environmental problems, however, there may not be a direct linear relationship between the amount an individual emits and the amount of damage they produce. Acid rain formation, for instance, is not solely dependent on the emission of sulphur and nitrogen but also on weather conditions, the presence of oxidizing agents which encourage its formation and alkaline substances which depress it (Dolan, 1990; Park, 2013). This highly complicates the use of a market share liability approach.⁸

⁸ An alternative method for establishing liability is the 'causal apportionment' approach, which assigns liability to defendants based on the probability they would have caused the plaintiff's injury without the presence of the other defendants' actions (Rizzo and Arnold, 1980). This method, however, has an even greater epistemic burden. It requires not just knowledge of emissions quantities and environmental conditions but

In reply to this kind of problem, it has been argued that a principle of ‘you take the environment as you find it’ could be used (McGee and Block, 2011). Whatever effects environmental factors, such as oxidizing agents, may have on the amount of harm caused, the emitter can still be held fully liable. However, such properties do not just change an individual’s absolute contribution to harm but also their relative contribution and therefore liability. For example, local wind patterns can affect the transport of emissions and therefore the harm caused by emitters in different geographical locations. The prevailing wind in most parts of Britain, for example, comes from the southwest, meaning that those emitters who are to the northeast of a population or on the northeast coast may contribute less to damages (Lapworth and McGregor, 2008). This will not always hold, however, as factors such as topography and seasons cause variation in wind direction, leading to greater uncertainty. The conditions of the local environment can, therefore, alter people’s relative contributions as well as their absolute contributions.

Establishing causation between a defendant and a plaintiff’s rights violation therefore involves many epistemic challenges. The burden of proving that a defendant or group of defendants caused a specific injury will face many knowledge problems. This burden may be even greater than it first seems when we consider that there may be multiple uncertainties. There may be uncertainty in the link between the pollutant and the plaintiff’s injury, and between the pollutant and the defendant. In this case, to prove that a defendant is ‘more likely than not’ the cause of a plaintiff’s injury requires much greater evidence of at least one of the two parts of causation. For example, if the link between a pollutant and harm is 51% and the link between a pollutant and the defendant is 51%, this would not prove that the defendant was ‘more likely than not’ the cause of the plaintiff’s injury. In fact it is about half the probability required. When multiple uncertainties are present, proving overall causation to be ‘more likely than not’ requires much greater evidence linking the pollutant to the injury or to the emitter. For instance, if the link between a pollutant and harm is 60%, it would require evidence that the link between the defendant and the pollutant was 85%. The epistemic burden to prove that defendants are the cause of a specific rights violation may therefore be even greater in the tort approach than it first appears.

4.3 *Reducing the epistemic burden*

The high epistemic burden for the tort approach is due to its requirement to prove direct causation between a defendant, or group of defendants, and the rights violations of which particular plaintiffs complain. This individualist foundation means that large amounts of knowledge are required to prove such a link. As has been shown, if studies find that 30% of disease cases can be attributed to a pollutant, this would not be enough to prove that any one case or group of cases was caused by the pollutant, and even if this was 60%, it may still not be enough if some particularistic evidence is required or if there is also uncertainty about the source of the pollution. These factors significantly prohibit establishing causation-in-fact between a defendant and the injury of which the plaintiff complains. Alternatively, more collective approaches to

also the temporal sequences of the different contributing causes and the independent probabilities of causing harm for each polluter and each type of pollutant.

environmental problems which do not require the same form of causation will not face the same epistemic burden.

In a collective approach it would not be necessary to prove causation-in-fact between polluters and rights violations to particular individuals. Instead, action could be taken on the basis of evidence that pollution is causing harm within a population, without requiring evidence proving that it caused a particular injury to particular individuals/plaintiffs as in the tort solution. This collective alternative can take different forms, but consider as an example a state which looks to address environmental problems. This state would not, as in the neo-classical approach, need to calculate all the associated costs and benefits in order to determine the optimal policy. An approach which faces the epistemic challenges was discussed in Section 2. Instead, it could look to take action to reduce or eliminate pollutants where they are seen to be causing harm within a population.

This state would face a lower epistemic burden than in tort litigation. It would look to see if there is evidence that pollution is causing harm without requiring proof that it was causing harm to any specific individual or group of individuals as in the tort approach. Say, for instance, that epidemiological studies have shown that there is a 30% increase in disease cases in areas which are exposed to a pollutant. These studies would fail to prove that the pollutant 'more likely than not' caused any one individual or group of individuals disease, as would be required by causation-in-fact in tort law. However, such studies are evidence that this pollutant is causing harm and rights violations within the population. It is evidence that the pollutant is causing cases of disease within the population despite the fact that it cannot prove any particular disease cases were 'more likely than not' caused by the pollutant. So, while the tort approach would fail to take action on the basis of this evidence, the collective approach could take action to reduce the pollution to non-harmful levels or eliminate it completely. This collective alternative would also not need to establish a link between particular polluters and particular injuries within a population, reducing these challenges. Rather it would only need to establish a link between polluters and the population generally. The collective approach, therefore, has a lower epistemic burden than the tort approach. It only requires evidence that harm is being caused rather than evidence that harm is being caused to particular plaintiffs by particular defendants.

Of course some evidence above correlation may also be required, such as possible causal mechanisms by which the pollution could produce the given harm. However, such evidence could also be necessary in a tort solution and would be less burdensome than the additional requirement of particularistic evidence or the exposure levels of plaintiffs. The tort solution therefore has a greater epistemic burden than this collective solution. Its individualist foundation of requiring proof that particular defendants caused rights violations to particular plaintiffs produces a number of knowledge problems when faced by complex environmental problems. Alternatively, a more collective approach has a lower epistemic burden, as it only requires evidence that some harm is being caused within a population and not that harm is being caused to particular plaintiffs.

In addition to having this lower epistemic burden, a collective alternative may have a greater ability to deal with its respective burden. In a tort system the burden of proof falls on the plaintiff. It is the responsibility of the plaintiff to establish that the defendant caused their injury. As we can see from the discussion above, establishing causation requires a large amount of evidence collection, specialised knowledge and scientific studies. It is therefore a very expensive and time-consuming process. Lots of plaintiffs

simply lack the resource to do this, and tort cases fail to get off the ground as a result. The tort solution is therefore often thwarted by its epistemic burden. A collective solution, however, may have much greater resources at its disposal. It can have a greater capacity to fund evidence collection as well as scientific studies and research, giving it a greater ability to deal with related knowledge problems. An institution, such as a state, can also have options at its disposal which a plaintiff would not. For instance, it can monitor emitters or require them to keep records of their emissions. Harms from environmental pollutants often occur after long time lags, sometimes years, and in the meantime rates of emission may change or polluter may stop emitting completely. This hugely restricts a plaintiff's ability to prove their damages were caused by the defendants. A collective institution's ability to take measures, such as to monitor and keep records over long time periods, increases its ability to deal with these problems.

Some Austrian writers have suggested that problems surrounding causation can be reduced, as the tort approach will help increase the capability of environmental science and forensics (Anderson and Leal, 2001; McGee and Block, 2011). According to this argument, the tort system would create a greater demand on markets for environmental science, encouraging innovation and new technologies which could help establish causation in environmental problems. However, there is no reason why a collective response, which would also require environmental forensics, would not create the same demand for innovation, while also having a lower epistemic burden to reduce than the tort approach.

A collective alternative, therefore, by only requiring evidence of harm, rather than evidence of causation between particular defendants and injuries to particular plaintiffs, has a lower epistemic burden than the tort law approach advocated by Austrian economics. As well as this, it also has a greater capacity to deal with its respective burden and is therefore less likely to fail as a result of knowledge problems.

5. The limits of knowledge and the limits of markets

As we have seen, there are significant epistemic problems facing the Austrian school's approach to the environment. Austrian economics is grounded on the view that society is so large, complex and dynamic that it cannot possibly be understood in its totality, and the claim that it can is a fallacy. However, once the same level of complexity is acknowledged in ecological and biological systems, the Austrian approach can be seen to suffer from a simpler fallacy. The natural world shares the complex, interconnected and dynamic features of society highlighted by the Austrian school, and these features also prevent us from obtaining a complete understanding of its internal workings.

This highlights a deeper tension between the limits to human reason Austrians identify in the social sciences and what they believe possible in the natural sciences. Hayek was highly critical of what he called 'Cartesian Rationalism'; the belief that society can be understood in its totality and then subjected to human control (Hayek, 1948A, 2013). However, he made no such criticism of the limits to human reason in the natural sciences. This distinction between the limits to knowledge in the social and natural world is in conflict with the prescriptions of Austrian economics. This tension has been noted by Gamble (2006, p. 130):

[Hayek] never extended to natural science and technology his critique of constructivist rationalism in social science. Although rationalism has retreated in the social sphere, it still has few restraints in its quest to master and control the natural world, posing increasingly serious questions for the civilization that Hayek so valued.

The tort law approach to environmental problems is at odds with Austrian's own epistemic foundations. In requiring a convincing map of cause and effect, their approach is based on a flawed epistemological assumption about the scope of human understanding in the natural sciences. Like the social world, the natural world of ecological and biological systems exhibits complexities which limit our ability to fully understand them. Once this is acknowledged, the tort law approach to the environment can be seen to itself suffer from significant knowledge problems. We often cannot establish, even to the level of 'more likely than not', which particular individuals were responsible for particular rights violations.

These problems for the tort law approach are not an isolated legal problem for Austrian economics, but have wider implications for their view of the market order. Courts are not separate from the market but have a vital role in regulating the market order. Property rights violations are failures in the market's capacity to coordinate individuals in pursuit of their ends. They are cases where people's plans come into conflict with the plans of others. In such cases it is the role of judges to intervene and correct these deviations from market coordination. For this reason, judges are for Hayek (2013, p. 91) 'an institution of a spontaneous order'. They are 'called in to correct disturbances' in the market so that it can continue to coordinate individuals in the pursuit of their own ends. The implication of the epistemic problems explored here is that the spontaneous market order will not be able to coordinate in a way that will avoid complex environmental problems. Acid rain, chlorofluorocarbons and air pollution are, from an Austrian perspective, cases where people's actions do not respect property rights and conflict with the plans of others. However, judges are unable in these cases to intervene so as to regulate the market order. Even in a world of well-defined property rights in environmental goods and well-functioning free markets, large complex environmental problems will still persist. Such problems are better resolved by moving to more collective responses which have a lower epistemic burden and greater ability to deal with the knowledge problems produced by the natural world.

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